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CURING DRAINAGE ILLS

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IN THE Green Section Bulletin of Dec. 1921, was a statement which had it been heeded by golf architects and construction superintendents would have saved countless dollars and endless worry. These few words of advice were contained in "Meditations of a Peripatetic Golfer." They were, "It is well to remember that 75% of all putting green troubles are due to lack of drainage." Perhaps in present days this 75% may be quite high, with the amount of drainage which has been done in recent years, but when we stop to consider the amount of water which is applied to a green, the question of drainage becomes a very significant factor.

In using a sprinkler delivering 20 gallons a minute, in 2 hours and 36 minutes 1 inch of water is applied to a green of 5,000 sq. ft. The number of hours which the green is watered gives an idea how many inches of water is applied over a given period of time. The average rainfall per month during the period of June to September in this section is around 3.2 inches. Add this to the amounts of water applied by irrigation and the need of drainage is very apparent.

Effects of poor dainage are numerous:

(1) **Depth of roots is decreased.** Plants growing in soils that are water soaked develop shallow root systems. The water table in a poorly drained soil gradually comes nearer the surface. The roots which are deep in the soil rot off when the moisture becomes excessive and we find the root system confined to the very surface of the soil. This situation was very noticeable in this section during the season of 1932. The rainfall in the spring months was unusually abundant. The soils on poorly drained greens became saturated. This resulted in a restricted root system instead of the normal deep rooted plants which we seek in the spring. Consequently the grass plant went into the summer months in weakened condition. The summer was averse to this condition, it being as excessively hot and dry as our spring was wet. Result—much turf succumbed through lack of moisture because the root system was so restricted that it was almost impossible to apply water often enough. The weakened condition of the turf also made it easy prey for diseases and insect pests.

(2) **Results in a much colder soil.** Waterlogged soils are much slower to warm up. The air spaces in the soil become completely filled with water. The soil is naturally much more difficult to warm up because it takes a great deal more heat to raise the temperature of a given volume of water one degree than to raise temperature of a like volume of air one degree. Fertilizer applications in the spring on such poorly drained greens are consequently slower in taking effect.

(3) **Physical condition of the soil becomes poor.** We are constantly ad-

vised by players that our greens are hard or won't hold a pitch shot. When we analyze the situation it may be largely attributed to poor drainage particularly on the heavier types of soils. The constant play of greens which contain too much moisture brings about a puddled condition. When a soil in plastic condition has been pressed together until it has become practically impervious to air and water, it is said to be puddled. The development of gelatinous and viscous colloidal material seems to be the controlling factor in such a condition, the pore space of a puddled green being filled with such material. When a soil in this condition drys, it becomes hard and dense. When this situation occurs there is only one remedy—the green must be torn up. When the physical condition becomes poor there is actually a decrease in the amount of film or capillary water which that soil will hold because capillarity is decreased.

(4) **Activity of favorable soil organisms is decreased.** Most of our beneficial soil bacteria and fungi are aerobic or air-loving. When the air spaces in the soil become filled with water they cannot exist. Their place is taken by organisms which are able to live in the absence of air or in especially moist conditions. These organisms are undesirable. They cause toxic conditions in the soil, which are detrimental to the growth of grass. In this group also are found disease-producing organisms, such as brown patch, snow mold and leaf spot. Records show that their attacks are more severe in seasons of abundant rainfall. Experimental evidence shows that the attacks of brown patch are more frequent and much more severe on poorly drained turf.

(5) **Winter kill is usually more severe on poorly drained greens.** The roots on the green are very shallow. Any heaving from freezing and thawing is apt to tear the roots loose from the soil, causing damage through drying out before they can be rolled down in the spring. Depressions hold water over winter which might cause the turf to be killed out in those areas through the exclusion of air.

Correcting Drainage Troubles

Now let us consider the correction of this condition. By drainage we mean the prevention of surplus water getting on or into the soil, as well as the removal from the surface and the interior of the soil the surplus water which cannot be intercepted. We therefore have two kinds of drainage to consider, surface drainage and sub-surface drainage.

Surface drainage consists of the prevention of surplus water getting on to the green as well as the removal of all surplus water from the surface of the green.

In preventing surplus water getting on to a green it is necessary to prevent seepage or overwash from higher areas. Where greens are built into the downward slope of a hill, a sloping ditch or swale on the hill side of the green will serve to carry excess water around the green. The same is true where the front of the green is at the bottom of the slope of a hill, except that it might interfere with the approach to the green. When such is the case a tile line with several catch basins might be used. In other situations a ridge or bank can be used to turn the water away from the green. Traps can sometimes be employed to intercept such water.

Flat Greens Court Troubles

It is advisable to give serious consideration to this phase of surface drainage, since overwash can cause much damage by carrying in foreign materials, particularly weed seeds, and by the erosive and puddling action of the water itself. Seepage can best be taken care of by tile. The removal of surplus water from the surface is provided for only by the proper construction of the surface of the green. The slope of the green will determine how fast excessive water can get off, so it is well to have a fairly good slope to the green. No hard and fast rule can be laid down as to what this slope should be, but I would say it should be at least 6 inches in 100 ft. This type of drainage is particularly valuable in the winter when the snow is thawing or rains occur, a time when the ground is apt to be frozen and sub-surface tile lines are not functioning. Much winter kill can be prevented.

Sub-surface drainage consists of the removal of surplus water from the interior of the soil. For our purpose it is accomplished by tiling.

No definite procedure can be set down which would take care of every green tiling problem. The soil type and structural characteristics of the soil particles is an important factor. Water runs through a sandy soil quickly because the spaces between the individual particles are large,

Ridgewood's 155 yard eighth of the 27 hole layout where the Ryder cup matches will be played September 28 and 29. Trees tightly border many of the Jersey course's holes and may trouble the Britishers who are accustomed to open courses.

while water moves slowly through clay soil because the particles are small. Clay soils therefore require tile lines placed closer together than do sandy soils if we are to have rapid drainage. Soils also vary a great deal in texture, even soils of the same type, and possess such different water holding capacities that it is almost impossible to indicate the proper depth and placing of the lines for all soils.

A certain amount of experimenting might be necessary to determine the drainage needs of the soil or soils on any particular course. However, certain generalities applicable to most all drainage conditions on greens were worked out. In putting greens, tiles should be placed at a depth of 1½ to 2 feet in clay soil; and 2 to 2½ feet in sandy soils. The laterals should be from 15 to 20 feet apart in clay soils and 30 to 40 feet in sandy soils. A fall of at least 1 inch in 20 feet should be provided for, remembering that the greater the fall the greater the capacity of the system. On a green which has very heavy soil, and in a very soggy condition, it would be well to place the tile lines no more than 15 feet apart at a depth of 1½ feet with as much fall or slope to the tile as possible. The size of the tile used depends upon the length of the laterals. For laterals up to 1,000 feet in length, 4 inch tile should be used. If the green is exceptionally large a 6 inch tile should be used for the main and 4 inch for the laterals. The types of tile most often used are the common porous or agricultural, vitrified, and cement. Vitrified and cement are stronger and less likely to break under pressure from heaving, so it is safer to use these types.

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The concluding installment of Mr. Ream's article on drainage, in which practical suggestions from his observation of successful greenkeepers work are given, will appear in October GOLFDOM.

Tillinghast Joins PGA Staff As Architect Consultant

A. W. TILLINGHAST, veteran architect of many noted courses, has been engaged by the PGA to act in an advisory capacity with pros, officials and architects for clubs whose pros are PGA members.

"Tilly" already has gone over plans for course remodeling with a number of clubs. He will be assigned to different sections as fast as time permits. There is no charge for the Tillinghast service to PGA members. He will not supervise any construction work. PGA officials state the Tillinghast appointment has encouraged club employment of architects to supervise work agreed on after initial conferences with Tilly.